

## **Subsurface Contaminant Transport**

CE 571

Winter 2012

Assigned: March 1, 2012

Due: Friday, March 16, 2012 by 1:45 p.m.

Homework No. 4/5

1. List and describe (e.g., limitations/advantages) six possible approaches to estimating the retardation factor from breakthrough curves describing the transport of a reactive solute.
2. How would you modify the analytical solution we used in Homework no. 1 to account for a solute undergoing retarded transport defined by  $R$ ? Check your assumption/approach using that analytical solution and present your results graphically for a solute with  $R=1$  vs. 5 vs. 10.
3. Derive the nondimensional form of the ADE assuming a reactive solute undergoing instantaneous, linear sorption/desorption.
4. How would you incorporate instantaneous, nonlinear sorption/desorption (assuming the Freundlich model) into the ADE? What assumption could you make to allow for a nondimensional solution to the ADE? Rewrite your nondimensional equation and terms accordingly.
5. Derive the nondimensional form of the ADE assuming a nonreactive solute in a physically heterogeneous porous media made up of mobile and immobile water contents.
6. Derive the nondimensional form of the "two-site" ADE assuming a reactive solute undergoing rate-limited, linear sorption/desorption.
7. Derive the nondimensional form of the ADE assuming a reactive solute (as in problem no. 3) in a physically heterogeneous porous media made up of mobile and immobile water contents (as in problem no. 5).